IFW AF/1745

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Applicant:	Daniel O. Jones et al.	§	Art Unit:	1745
Serial No.:	09/773,704	§	Examiner:	Raymond Alejandro
Filed:	January 31, 2001	§		
Title:	Technique And Apparatus To Control The Response Of A Fuel Cell System To Load Transients	§	Docket No.	PUG.0056US (734)

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPEAL BRIEF TRANSMITTAL

Dear Sir:

Transmitted herewith in triplicate is the Appeal Brief in this application. The Notice of Appeal was filed on February 17, 2004.

Pursuant to M.P.E.P. § 1208.02, there is no fee due for this Appeal, because the Examiner reopened prosecution after filing of the first Appeal Brief on July 7, 2003. The Commissioner is authorized to charge any additional fees or credit any overpayment to Deposit Account No. 20-1504 (PUG.0056US).

Respectfully submitted,

Date: April 20, 2004

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Date of Deposit: April 20, 2004
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Janice Munoz

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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APPEAL BRIEF

Dear Sir:

Applicant hereby appeals from the Final Rejection dated November 14, 2003, finally rejecting claims 1-8 and 19-27.

I. REAL PARTY IN INTEREST

The real party in interest is Plug Power Inc., the assignee of the present application by virtue of the assignment recorded at Reel/Frame 011527/0764.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

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III. STATUS OF THE CLAIMS

The application was originally filed with claims 1-18. Due to a restriction requirement, claims 9-18 have been cancelled. Claim 19, also on appeal, was added during prosecution. Claims 1-8 and 19 have been finally rejected and are the subject of this appeal.

IV. STATUS OF AMENDMENTS

An Amendment (copy enclosed) is being filed concurrently with this Appeal Brief to cancel claims 20-27. Because this amendment further narrows down the issues on appeal, it is assumed for purposes of this appeal that the amendment will be entered.

V. SUMMARY OF THE INVENTION

Referring to Fig. 1, an embodiment of a fuel cell system 10 in accordance with the invention includes a fuel cell stack 20 (a PEM-type fuel cell stack, for example) that is capable of producing power for an external load 50 (a residential load, for example) and parasitic elements (fans, valves, etc.) of the system 10 in response to fuel and oxidant flows that are provided by a fuel processor 22 and an air blower 24, respectively. In this manner, the fuel cell system 10 controls the fuel production of the fuel processor 22 to control the fuel flow that is available for electrochemical reactions inside the fuel cell stack 20. This rate of fuel flow to the fuel cell stack 20, in turn, controls the level of power that is produced by the stack 20. Alternatively stated, the fuel cell system 10 controls the level of fuel production by the fuel cell processor 22 to establish a particular

output current of the fuel cell stack 20. The output current (and power) is received by the load 50 and the parasitic elements of the fuel cell system 10. Specification, pp. 3-4.

As described below, the fuel cell system 10 bases (at least in part) its regulation of the fuel processor 22 on the power that is consumed (or "demanded") by the load 50, as the fuel cell system 10, in general, attempts to match the power that is provided by the fuel cell stack 20 with the power that is consumed by the load 50 and the various parasitic elements of the system 10. Otherwise, when too much fuel is produced by the fuel processor 22, excess fuel either passes through the fuel cell stack 20 or bypasses around the stack 20 (via conduit 35) to the oxidizer 38. When the fuel processor 22 does not produce enough fuel, the fuel cell stack 20 does not produce the required power, and stack voltage and cell voltages of the stack 20 may decrease to undesirable levels. Specification, p. 4.

The power that is consumed by the load 50 may vary over time, as the load 50 may represent a collection of individual loads (appliances and/or electrical devices that are associated with a house, for example) that may each be turned on and off. As a result, the power that is consumed by the load 50 may change to produce a transient. In the context of this application, a "transient in the power consumed by the load 50" refers to a significant change in the power (that is consumed by the load 50) that deviates from the current steady state level of the power at the time the transient occurs. The transient may have a time constant that is on the same order or less than the time constant of the fuel processor 22. In the context of the application, the phrase "down transient" refers to a negative transient in the power that is consumed by the load 50, and the phrase "up

transient" refers to a positive transient in the power that is consumed by the load 50. Specification, p. 4.

For various reasons, the fuel processor 22 may not respond quickly to a down transient to decrease its fuel output. As examples, the fuel processor 22 may be incapable of rapidly adjusting to transients in the power that is consumed by the load 50 and/or the rate at which the fuel processor 22 decreases its fuel flow output may be limited, for purposes of decreasing the level of carbon monoxide (CO) that is produced by the fuel processor 22 due to a rapid change in the fuel processor's operating point. However, regardless of the reason for the fuel processor 22 not immediately responding to the down transient, after a down transient, a period of time exists in which the fuel processor 22 supplies a fuel flow that is at a level for providing an output current level that is larger than the current that is consumed by the load 50 and the parasitic elements of the system 10. Therefore, a conventional fuel cell system may divert some of this fuel flow to an oxidizer, or flare, to burn off some of the fuel so that the appropriate fuel flow is provided to the fuel cell stack. Otherwise, unconsumed fuel passes through the fuel cell stack to the oxidizer. Specification, pp. 4-5.

However, unlike conventional arrangements, the fuel cell system 10 takes measures, if possible, to not burn off excess fuel. In this manner, the fuel cell system 10 provides all of the fuel flow that is produced by the fuel processor 22 to the fuel cell stack 20 (under certain conditions, described below) during the time interval that follows a down transient and at the same time, the system increases the power that is consumed from the fuel cell stack 20 to cause the stack 20 to consume the additional fuel. In this

manner, the fuel cell system 10 adds an additional load 43 onto the fuel cell stack 20 during this time interval to minimize the fuel that is diverted to an oxidizer 38 of the system 10. Thus, this technique enhances the efficiency of the fuel cell system 10. Specification, p. 5.

As an example, in some embodiments of the invention, the load 43 may include a battery 41 that has its output terminals electrically coupled to the fuel cell stack 20 to supplement the power that is provided to the stack 20 after up transients times when the power that is consumed by the load 50 rapidly increases and the fuel cell stack 20 does not provide enough power for the load 50. However, in the time interval after a down transient, the battery 41 may be charged and thus, receive power from the fuel cell stack 20. Therefore, this technique of temporarily increasing the load on the fuel cell stack 20 enhances the overall efficiency of the system 10, as compared to burning off excess fuel. As described below, it is possible that at a given time, the battery 41 may be fully charged and thus, may not capable of receiving power. For this scenario, in some embodiments of the invention, the fuel cell system 10 does not route all of the additional fuel to the stack 20, but rather, the system 10 routes fuel that will not be consumed by the stack 20 to the oxidizer 38. Specification, p. 5.

Thus, in general, the fuel cell system 10 may use a technique 100 (depicted in Fig. 2) to respond to down transients. In the technique 100, the fuel cell system 10 determines (diamond 102) whether a down transient has occurred. If not, control returns to diamond 102 until a down transient is detected. Otherwise, if a down transient has occurred, the fuel cell system 10 determines (diamond 104) whether the load 43 is capable of receiving

the additional available power (i.e., additional current). For example, the load 43 may include the battery 41 (in some embodiments of the invention), a device that may be fully charged and thus, cannot receive the additional power. If this is the case, then the fuel cell system 10 diverts (block 105) fuel from the fuel flow that is received by the fuel cell stack 22 to the oxidizer 38 and control returns to diamond 102. Otherwise, if the load 43 can receive additional power, then the technique 100 includes using (block 106) the load 43 as an additional power/current sink to receive the additional power (from the fuel cell stack 20) that is no longer being consumed by the load 50 after the down transient. Subsequently, the fuel cell system 10 includes determining (diamond 108) if there is still a need to sink power that is not being consumed by the load 50. If so, control returns to diamond 104. Otherwise, control returns to diamond 102. Specification, pp. 5-6.

Referring back to Fig. 1 to describe more specific features of the fuel cell system 10, in some embodiments of the invention, the fuel cell system 10 includes a controller 60 to detect the down transients and regulate the fuel processor 22 accordingly. More particularly, in some embodiments of the invention, the controller 60 detects the down transients by monitoring the cell voltages, the terminal stack voltage (called "V_{TERM}") and an output current (called I1) of the fuel cell stack 20. From these measurements, the controller 60 may determine when a down transient occurs. Specification, p. 6.

To obtain the above-described measurements from the fuel cell stack 20, the fuel cell system 10 may include a cell voltage monitoring circuit 40 to measure the cell voltages of the fuel cell stack 20 and the V_{TERM} stack voltage; and a current sensor 49 to measure the I1 output current. The cell voltage monitoring circuit 40 communicates (via

a serial bus 48, for example) indications of the measured cell voltages to the controller 60. The current sensor 49 is coupled in series with an output terminal 31 of the fuel cell stack 20 to provide an indication of the output current (via an electrical communication line 52). With the information from the stack 20, the controller 60 may execute a program 65 (stored in a memory 63 of the controller 60) to detect a down transient and control the fuel processor 22 accordingly via electrical communication lines 46. Specification, p. 6.

In some embodiments of the invention, the controller 60 builds a margin into its detection of a down transient. In this manner, the controller 60 may establish a lower threshold below the current steady state level of the power that is consumed by the load 50 and determine a down transient has occurred when the power decreases below this lower threshold. The lower threshold may be a predetermined percentage drop or an absolute below the current steady state level of the power that is consumed by the load 50, as just a few examples. Specification, pp. 6-7.

A specific implementation of the technique 100 (according to different embodiments of the invention) is described below, although other implementations are possible. Referring to Fig. 3, in some embodiments of the invention, the program 65, when executed by the controller 60, may cause the controller 60 to perform a technique 150 to regulate the I1 output current from the fuel cell stack 20 in response to down transients. In particular, the fuel cell system 20 may use the battery 41 as the load 43. Specification, p. 7.

In the technique 150, the controller 60 determines (diamond 152) whether a down transient has occurred. If not, control returns to diamond 152 until a down transient is detected. Otherwise, if the controller 60 determines that a down transient has occurred, the controller 60 determines (diamond 154) whether the battery 41 is capable of being charged. To make this determination, in some embodiments of the invention, the controller 60 receives an indication (via an electrical communication line 31 (see Fig. 1)) of a terminal voltage (called V_{DC} (see Fig. 1)) of the battery 41, and from this indication, determines whether the battery 41 can accept charge. As an example, the battery 41 may be a lead acid battery (in some embodiments of the invention) whose terminal voltage indicates a charge level of the battery 41. If the V_{DC} voltage is above a predefined threshold, then the controller 60 considers the battery 41 to be fully charged and not capable of receiving current (called I2 (see Fig. 1)) from the fuel cell stack 20. Otherwise, the controller 60 deems that the battery 41 is capable of being charged and thus, is capable of receiving the I2 current. Specification, p. 7.

Alternatively, in some embodiments of the invention, the controller 60 may monitor an amount of energy that is stored in the battery 41 when the battery 41 charges and also monitor energy that is provided by the battery 41. Therefore, by monitoring the charge into and out of the battery 41 (i.e., by monitoring the net charge remaining in the battery 41), the controller 60 may determine when the battery 41 can and cannot be charged. Specification, p. 7.

Thus, if the controller 60 determines (diamond 152) that the battery 41 is not capable of receiving charge, the controller 60 diverts (block 158) fuel from the fuel flow

that is received by the fuel cell stack 22 to the oxidizer 38 and control returns to diamond 152. This diversion of the fuel flow to the oxidizer 38 may be accomplished by the controller 60 actuating (via electrical communication lines 23, for example) the appropriate control valve(s) 44 to divert the flow to the oxidizer 38 via a flow line 35. Otherwise, if the battery 41 is capable of being charged, the controller 60 regulates the V_{DC} voltage to a sufficient increased level to charge the battery 41 and cause the I2 current to flow into the battery 41 to charge the battery 41, as depicted in blocks 156 and 158. Specification, pp. 7-8.

As the battery 41 charges, the controller 60 continues to monitor the current that is consumed by the load 50 to determine (diamond 160) when the fuel processor 12 has fully responded to the down transient, i.e., to determine when the I1 current that is provided by the fuel cell stack 20 is sufficiently matched to the current consumed by the load 50 and the current consumed by parasitic elements of the fuel cell system 10. As long as this has not occurred, control returns to diamond 154 to continue charging the battery 41 (if it is still capable of receiving additional charge). Otherwise, control returns to diamond 152. Specification, p. 8.

Fig. 4 depicts an exemplary time profile of power that is consumed by the load 50. In this scenario, from time T_0 to time T_1, the load 50 consumes a power near a level called L_1. At time T_1, however, the power consumed by the load 50 transitions (as indicated by the decline 200) to a new power level called L_2. The power consumed by the load 50 remains near the L_2 level for the duration of the depicted scenario. Specification, p. 8.

At time T_1, the controller 60 does not control the fuel processor 22 to immediately drop its fuel production to produce the appropriate level of power to sustain the L_2 power level. Instead, the controller 60 decreases the fuel output of the fuel processor 22 at a predefined rate, as indicated by a slope 202 (see Fig. 5) at which the I1 current declines from time T_1 to time T_2, a time at which the I1 current matches the current consumed by the load 50 and the parasitic elements of the fuel cell system 10. Referring also to Fig. 6, at time T_1, the I2 current into the battery 41 sharply increases (as depicted by an increase 204) due to the charging of the battery 41 by the controller 60. From time T_1 to T_2, the I2 current decreases pursuant to a negative slope 206, as the I1 current that is produced by the fuel cell stack 20 decreases pursuant to the slope 202 (Fig. 5) during this time interval. At time T_2, the fuel processor 22 is providing a level of fuel that causes the I1 current to closely match the current that is consumed by the load 50 and the parasitic elements of the fuel cell system 10. Specification, p. 8.

Referring back to Fig. 1, among the other features of the fuel cell system 20, the system 20 may include a DC-to-DC voltage regulator 30 that regulates the V_{TERM} stack voltage to produce the V_{DC} voltage. The V_{DC} voltage is converted into an AC voltage via an inverter 33 of the fuel cell system 10. The output terminals 32 of the inverter 33 are coupled to the load 50. The fuel cell system 10 also includes the control valves 44 that may be controlled by the controller 60 to divert some of the fuel flow that is received by the fuel cell stack 20 to oxidizer 38 via the flow line 35. The control valves 44 may also provide emergency shutoff of the oxidant and fuel flows to the fuel cell stack 20. The control valves 44 are coupled between inlet fuel 37 and oxidant 39 lines and the fuel and

oxidant manifold inlets, respectively, to the fuel cell stack 20. The inlet fuel line 37 receives the fuel flow from the fuel processor 22, and the inlet oxidant line 39 receives the oxidant flow from the air blower 24. The fuel processor 22 receives a hydrocarbon (natural gas or propane, as examples) and converts this hydrocarbon into the fuel flow (a hydrogen flow, for example) that is provided to the fuel cell stack 20. Specification, p. 9.

The fuel cell system 10 may include water separators, such as water separators 34 and 36, to recover water from the outlet and/or inlet fuel and oxidant ports of the fuel cell stack 20. The water that is collected by the water separators 34 and 36 may be routed to a water tank (not shown) of a coolant subsystem 54 of the fuel cell system 10. The coolant subsystem 54 circulates a coolant (de-ionized water, for example) through the fuel cell stack 20 to regulate the operating temperature of the stack 20. The fuel cell system 10 may also include the oxidizer 38 to burn any fuel from the stack 22 that is not consumed in the fuel cell reactions. Specification, p. 9.

For purposes of isolating the load 50 from the fuel cell stack 20 during a shut down of the fuel cell system 10, the system 10 may include a switch 29 (a relay circuit, for example) that is coupled between the main output terminal 31 of the stack 20 and an input terminal of the current sensing element 49. The controller 60 may control the switch 29 via an electrical communication line 51. Specification, p. 9.

In some embodiments of the invention, the controller 60 may include a microcontroller and/or a microprocessor to perform one or more of the techniques that are described herein when executing the program 65. For example, the controller 60 may include a microcontroller that includes a read only memory (ROM) that serves as the

memory 63 and a storage medium to store instructions for the program 65. Other types of storage mediums may be used to store instructions of the program 65. Various analog and digital external pins of the microcontroller may be used to establish communication over the electrical communication lines 23, 46, 51 and 52 and the serial bus 48. In other embodiments of the invention, a memory that is fabricated on a separate die from the microcontroller may be used as the memory 63 and store instructions for the program 65. Other variations are possible. Specification, pp. 9-10.

VI. ISSUES

A. **Can claims 1-8 and 19 be anticipated or rendered obvious when the cited reference fails to teach or suggest all of the limitations of independent claim 1?**

B. **Can claim 2 be anticipated or rendered obvious when the cited reference fails to teach or suggest all of the limitations of this claim?**

C. **Can claim 3 be anticipated or rendered obvious when the cited reference fails to teach or suggest all of the limitations of this claim?**

D. **Can claims 4 and 5 be anticipated or rendered obvious when the cited reference fails to teach or suggest all of the limitations of independent claim 4?**

E. **Can claims 6 and 7 be anticipated or rendered obvious when the cited reference fails to teach or suggest all of the limitations of independent claim 6?**

F. **Can claim 19 be rendered obvious when the Examiner has failed to establish a *prima facie* case of obviousness for this claim?**

VII. GROUPING OF THE CLAIMS

Claims 1 and 8 can be grouped together; claims 4 and 5 can be grouped together; claims 6 and 7 can be grouped together; and claims 2, 3 and 19 are separately patentable for the reasons set forth below. With this grouping, all claims of a particular group stand or fall together. Furthermore, regardless of the grouping set forth by the Examiner's rejections, the claims of each group set forth in this section stand alone with respect to the other groups. In other words, any claim of a particular group set forth in this section does not stand or fall together with any claim of any other group set forth in this section.

VIII. ARGUMENT

All claims should be allowed over the cited references for the reasons set forth below.

A. Can claims 1-8 and 19 be anticipated or rendered obvious when the cited reference fails to teach or suggest all of the limitations of independent claim 1?

Claim 1 recites a method of operating a fuel cell stack. This method includes providing a fuel flow to the fuel cell stack to produce power. At least some of the power that is produced by the fuel cell stack is consumed by a first load. The method includes in response to a decrease in at least one of the power that is produced by the fuel cell stack and the power that is consumed by the first load, determining whether to route at least some of the power that is produced by the fuel cell stack and is not consumed by the first load to a second load. The method includes based on this determination, selectively

routing at least some of the power that is produced by the fuel cell stack and is not consumed by the first load to the second load.

The Examiner rejects independent claim 1 under 35 U.S.C. § 102(b) as being anticipated, or in the alternative, under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,714,874 (herein called "Bonnefoy"). Bonnefoy generally teaches a fuel cell voltage generator. This generator includes a fuel cell 1, a battery 3 and a load 4, as depicted in Figure 1 of Bonnefoy. Bonnefoy states, "if the load 4 requires an electric power lower than the one available at the fuel cell 1 terminals, the battery takes profit from the excess of electric energy and recharges." Bonnefoy, 2:58-60.

Bonnefoy fails to anticipate or render obvious independent claim 1 for at least the reason that Bonnefoy neither teaches nor suggests all of the limitations of independent claim 1. For example, claim 1 states that *in response to* at least one of a decrease in power that is produced by a fuel cell stack and a power that is consumed by a load, *determining* whether to route at least some of the power that is produced by the fuel cell stack and is not consumed by the first load. (*emphasis added*). *Based* on this determination, the method of claim 1 includes *selectively* routing at least some of the power that is produced by the fuel cell stack. (*emphasis added*). Contrary to the limitations of claim 1, Bonnefoy teaches *automatically* routing electric power to a battery in the event of a deficiency between the power that is consumed by the load 4 and the power that is available at fuel cell terminals. This is brought forth by the language cited above, stating that the battery "takes profit from the excess of electric energy and recharges." Bonnefoy, 2:58-60. Therefore, Bonnefoy does not disclose or suggest

determining whether to route excess energy to the battery; and thus, it follows, Bonnefoy does not teach or suggest selectively routing based on such a determination.

As pointed out in the numerous replies filed in this application and in the previously-filed Appeal Brief, Bonnefoy fails to teach all limitations of claim 1, such as the determining and selective routing of claim 1. In the Final Office Action mailed on November 14, 2003, (herein called the "Final Office Action"), the Examiner contends that the limitations (of independent claim 1) that are not explicitly taught in Bonnefoy are somehow inherent in Bonnefoy. Final Office Action, 5. However, for a missing claim limitation to be inherent in a reference, the limitation must <u>necessarily flow</u> from the reference. *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). This is not case here, as Bonnefoy teaches hard wiring the battery in place so that the battery takes excess profit from excess electric energy. Thus, as Bonnefoy teaches an alternative, the missing claim limitation does not necessarily flow from Bonnefoy.

It appears that in reaching the conclusion that the missing claim limitations are allegedly inherent in Bonnefoy, the Examiner is selectively reading portions of claim 1 instead of considering the claim language in its entirety. More specifically, turning to the language of claim 1, claim 1 recites, "in response to a decrease in at least one of the power produced by the fuel cell stack and the power consumed by the first load, determining . . . ." Thus, claim 1 recites that the determination occurs *in response to* the decrease in power (emphasis added). Although the Examiner goes at some length to recite various design criteria, etc., that may be involved in the design of Bonnefoy's circuit, there is no teaching, suggestion or necessary implication in Bonnefoy that a

determination is made *in response to* a decrease in power. Rather, the battery of Bonnefoy takes excess energy due to its hard wiring, not in response to some determination that power is decreasing. Although the circuitry of Bonnefoy may have been designed at some point in response to some determination of how the circuit should behave when power to the load decreases, the selective routing of energy to the battery of Bonnefoy does not occur *in response to* determining whether a power has decreased. Therefore, when the claim language is considered in its entirety, Bonnefoy fails to explicitly, implicitly or inherently teach or suggest the determination and selective routing of claim 1.

The Examiner fails to establish a *prima facie* case of obviousness for independent claim 1 for at least the reason that the Examiner fails to show where the prior art teaches or suggests the missing claim limitations. M.P.E.P. § 2143. *See Ex parte Gambogi*, 62 USPQ2d 1209, 1212 (Bd. Pat. App. & Int. 2001); *In re Rijckaert*, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993); M.P.E.P. § 2143. "Obviousness cannot be predicated on what is unknown." *See In re Spormann,* 363 F.2d 444, 448, 150 USPQ 449, 452 (CCPA 1966). Thus, the Examiner must show that one skilled in the art, *without knowledge of the claimed invention,* would have modified Bonnefoy to derive the claimed invention. The Examiner has failed to make this showing; and thus, for at least this reason has failed to establish a *prima facie* case of obviousness for claim 1.

Claims 2-8 and 19 are patentable for at least the reason that these claims depend from an allowable claim.

Therefore, the § 103 rejections of claims 1-8 and 19 are in error and should be reversed.

B. Can claim 2 be anticipated or rendered obvious when the cited reference fails to teach or suggest all of the limitations of this claim?

Claim 2 depends from claim 1 and recites that the determining includes determining whether the second load is capable of receiving at least some of the power produced by the fuel cell stack that is not consumed by the first load.

The Examiner rejects claim 2 under 35 U.S.C. § 102(e), or alternatively, under 35 U.S.C. § 103(a) in view of Bonnefoy. Claim 2 is patentable for at least the reason that this claim depends from an allowable claim for the reasons set forth above in the discussion of Issue A. Claim 2 is patentable for the additional, independent reasons that are set forth below.

Bonnefoy fails to anticipate or render obvious claim 2 for at least the additional, independent reason that Bonnefoy fails to teach or suggest determining whether a second load is capable of receiving at least some power that is produced by a fuel cell stack and is not consumed by a first load. More specifically, the Examiner relies on Bonnefoy's disclosure of the battery 3 as allegedly teaching the second load of claim 2. However, the Examiner fails to cite any language of Bonnefoy that implicitly, explicitly or inherently teaches or suggests determining whether the battery 3 is capable of receiving power that is produced by the fuel cell 1.

Thus, for at least the additional, independent reason that Bonnefoy fails to teach or suggest the additional claim limitations that are presented in dependent claim 2, the §§ 102 and 103 rejections of claim 2 are in error and should be reversed.

C. Can claim 3 be anticipated or rendered obvious when the cited reference fails to teach or suggest all of the limitations of this claim?

Claim 3 depends from independent claim 1 and recites that the second load includes a battery and further states that the determining includes determining whether the battery is capable of being charged using the power that is produced by the fuel cell stack and is not consumed by the first load.

The Examiner rejects claim 3 under 35 U.S.C. § 102(e), or alternatively, under 35 U.S.C. § 103(a) in view of Bonnefoy. Claim 3 is patentable for at least the reason that this claim depends from an allowable claim, for the reasons set forth above in connection with Issue A. Claim 3 is patentable for the additional, independent reasons that are set forth below.

Bonnefoy fails to anticipate or render claim 3 obvious for at least the reason that Bonnefoy fails to teach or suggest that additional limitations that are presented in claim 3. Bonnefoy merely states that the battery 3 "takes profit from the excess of electric energy and recharges." Bonnefoy, 2:58-60. Neither this language nor any other language of Bonnefoy that implicitly, explicitly or inherently teaches or suggests determining whether the battery 3 is capable of being charged.

Thus, for at least this additional, independent reason that Bonnefoy fails to teach or suggest the additional limitations that are set forth in claim 3, the §§ 102 and 103 rejections of claim 3 are in error and should be reversed.

D. Can claims 4 and 5 be anticipated or rendered obvious when the cited reference fails to teach or suggest all of the limitations of independent claim 4?

The method of claim 4 depends from independent claim 1, recites that the second load includes a battery and further states the selectively routing includes selectively charging the battery based on a determination whether to route power that is produced by a fuel cell stack and is not consumed by a first load.

The Examiner rejects claim 4 under 35 U.S.C. § 102(e), or alternatively, under 35 U.S.C. § 103(a) in view of Bonnefoy. Claim 4 is patentable for at least the reason that this claim depends from an allowable claim, for the reasons that are set forth above in connection with the discussion of Issue A. Claim 4 is patentable for the additional, independent reasons that are set forth below.

Bonnefoy fails to anticipate or render obvious claim 4 for at least the additional, independent reason that Bonnefoy fails to teach or suggest selectively charging a battery based on a determination whether to route at least some of the power that is produced by the fuel cell stack and is not consumed by the first load to a second load. Bonnefoy merely states that the battery 3 "takes profit from the excess of electric energy and recharges." Bonnefoy, 2:58-60. However, neither this language nor any other language of Bonnefoy that implicitly, explicitly or inherently teaches or suggests selectively

charging the battery 3 based on a determination whether to route power that is produced by a fuel cell stack and is not consumed by a first load.

Claim 5 is patentable for at least the reason that this claim depends from an allowable claim.

Thus, for at the additional, independent reasons that are set forth above, the §§ 102 and 103 rejections of claims 4 and 5 are in error and should be reversed.

E. Can claims 6 and 7 be anticipated or rendered obvious when the cited reference fails to teach or suggest all of the limitations of independent claim 6?

Claim 6 depends from independent claim 1 and further recites decreasing the fuel flow in response to the detection of the decrease.

The Examiner rejects claim 6 under 35 U.S.C. § 102(b), or alternatively, under 35 U.S.C. § 103(a) in view of Bonnefoy. Claim 6 is patentable for at least the reason that this claim depends from allowable claim 1 for the reasons that are set forth above in Issue A. Claim 6 is patentable for the additional, independent reasons that are set forth below.

Bonnefoy fails to anticipate or render obvious claim 6 for at least the reason that the Examiner fails to show where either Bonnefoy that implicitly, explicitly or inherently teaches or suggests decreasing a fuel flow in response to the detection of a decrease in at least one of a power that is produced by fuel cell stack and the power that is consumed by a load. Without such a teaching or suggestion, claim 6 is neither anticipated nor rendered obvious in view of Bonnefoy.

Claim 7 is patentable for at least the reason that this claim depends from an allowable claim.

Thus, for at least the additional reasons set forth above, the §§ 102 and 103 rejections of claims 6 and 7 are in error and should be reversed.

F. Can claim 19 be rendered obvious when the Examiner has failed to establish a *prima facie* case of obviousness for this claim?

The method of claim 19 depends from claim 1 and recites selectively routing at least some of the power that is produced by the fuel cell stack and not consumed by the first load between the second load and an oxidizer.

The Examiner rejects claim 19 under 35 U.S.C. § 103(a) in view of Bonnefoy, European patent application (herein called "the European patent application") and U.S. Patent Application Publication No. 2002/0076588 A1 (herein called "Singh"). Claim 19 is patentable for at least the reason that this claim depends from an allowable claim for the reasons that are set forth above in the discussion of Issue A. Claim 19 is patentable for the additional, independent reason set forth below.

The Examiner fails to establish a *prima facie* case of obviousness for claim 19 for at least the reason that the Examiner fails to show where the prior art contains the alleged suggestion or motivation to combine Singh with the European patent application and Bonnefoy to derive the claimed invention. "Obviousness cannot be predicated on what is unknown." *In re Spormann*, 150 USPQ 449, 452 (CCPA 1966). Thus, the Examiner must show with specific citations where the prior art contains the alleged suggestion or motivation. *See Ex parte Gambogi*, 62 USPQ2d 1209, 1212 (Bd. Pat. App. & Int. 2001);

In re Rijckaert, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993); M.P.E.P. § 2143. Because, based on the hindsight gleaned from the current application, the Examiner merely concludes the alleged suggestion or motivation exists without showing the existence of the alleged suggestion or motivation in the prior art, a *prima facie* case of obviousness has not been established for claim 19.

Thus, for at least these additional, independent reasons, the § 103 rejection of claim 19 is in error and should be reversed.

IX. CONCLUSION

Applicant requests that each of the final rejections be reversed and that the claims subject to this appeal be allowed to issue.

Respectfully submitted,

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APPENDIX OF CLAIMS

The claims on appeal are:

1. A method of operating a fuel cell stack, comprising:

providing a fuel flow to the fuel cell stack to produce power, at least some of the power produced by the fuel cell stack being consumed by a first load;

in response to a decrease in at least one of the power produced by the fuel cell stack and the power consumed by the first load, determining whether to route at least some of the power produced by the fuel cell stack and not consumed by the first load to a second load; and

based on the determination, selectively routing said at least some of the power produced by the fuel cell stack and not consumed by the first load to the second load.

2. The method of claim 1, wherein the determining comprises:

determining whether the second load is capable of receiving said at least some of the power produced by the fuel cell stack and not consumed by the first load.

3. The method of claim 1, wherein

the second load comprises a battery; and

the determining comprises determining whether the battery is capable of being charged using said power produced by the fuel cell stack and not consumed by the first load.

4. The method of claim 1, wherein

the second load comprises a battery; and

the selectively routing comprises selectively charging the battery based on the determination.

5. The method of claim 4, wherein the charging comprises regulating a terminal voltage of the battery to cause the battery to charge.

6. The method of claim 1, further comprising:

decreasing the fuel flow in response to the detection of the decrease.

7. The method of claim 6, wherein the routing occurs until the fuel flow is decreased to a level at which the power routed to the second load is approximately zero.

8. The method of claim 1, wherein the providing comprises operating a fuel processor to provide the fuel flow.

19. The method of claim 1, further comprising:

selectively routing said at least some of the power produced by the fuel cell stack and not consumed by the first load between the second load and an oxidizer.